Fermilab

Directorate

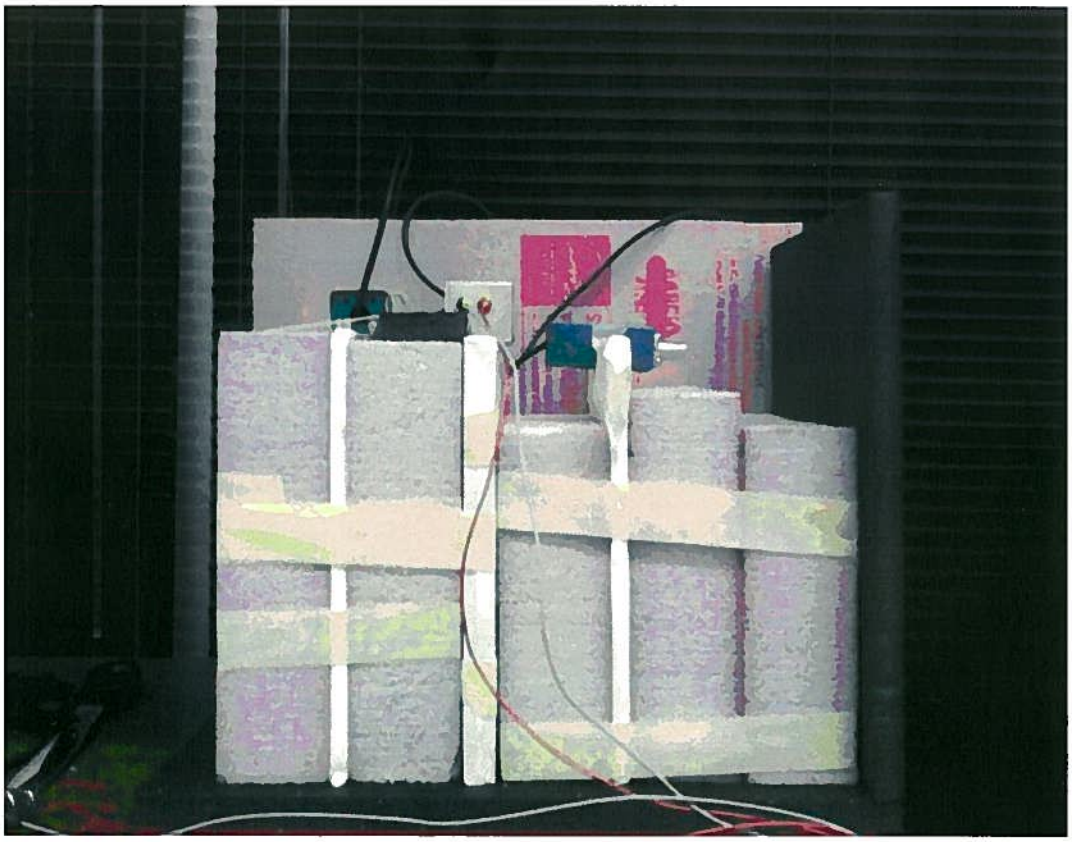
MEMORANDUM OF UNDERSTANDING

FOR THE 2011 FERMILAB TEST BEAM FACILITY PROGRAM

T-1012

TAUWER TEST

January 24, 2011



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INTRODUCTION

This is a memorandum of understanding between the Fermi National Accelerator Laboratory (Fermilab) and the experimenters of Carnegie Mellon University, University of Rome, and Fermilab who have committed to participate in beam tests to be carried out during the 2011 Fermilab Test Beam Facility program.

The memorandum is intended solely for the purpose of recording expectations for budget estimates and work allocations for Fermilab, the funding agencies and the participating institutions. It reflects an arrangement that currently is satisfactory to the parties; however, it is recognized and anticipated that changing circumstances of the evolving research program may necessitate revisions. The parties agree to modify this memorandum to reflect such required adjustments. Actual contractual obligations will be set forth in separate documents.

Description of Detector and Tests:

TAUWER is a proposed astroparticle experiment to detect ultrahigh energy TAU neutrinos, using detector towers arrayed on a mountainside looking down into a valley. This test is to study the possibility of replacing Hamamatsu miniature PMTs with SiPMs for readout by determining the response of scintillation detectors with SiPM readout to low energy electrons, 2 GeV or lower, as the beam will provide. The detector itself is a compact package shown in the picture on the cover. It was used in a parasitic test beam run on December 15, 2010, to compare the relative timing of the signals from three counters for MIPs. The only change for this new run is the insertion of 1.5 cm of Pb in front of counter 2 or counter 3 during most of the running. The experiment will take some electron data without Pb for calibration purposes. The apparatus will be mounted on the moving table in MT6.2B.

The light enclosure is made of polyurethane foam, as are the foam spacers. It is approximately a cube 25 cm on a side. The three scintillators are 0.7, 1.4, and 0.7 cm thick, each 19 x 19 cm square. Each has a single SiPM readout, seen in the picture. The SiPM operating voltage is 34 volts. This is introduced by BNC cables from power supplies in the electronics area. The red and white wires adapt the BNC cable to separate power and ground leads for the center counter. The SiPM signals are taken on RG174 cables to a local waveform digitizer (DRS4) adjacent to the optical box. The DRS4 is controlled by a PC located in the beam enclosure, operated remotely from the control room.

The trigger will use two additional scintillators mounted on fixed stands in front of and behind the moving table. These will be put in coincidence with a signal from the beam Cerenkov counter to identify the electron component of the low energy beam.

The Pb sheet will be enclosed in a polyethylene bag and inserted directly in front (relative to the beam direction) of scintillator 2 or scintillator 3. The time needed to open the box, insert the Pb

and remake the optical seal with black tape is about 15 minutes. Two such operations will be needed during the tests.

1 PERSONNEL AND INSTITUTIONS:

Spokesperson and Physicist in charge of beam tests: James Russ (Carnegie Mellon)

Fermilab liaison: Aria Soha

The group members at present are:

	Institution	Collaborator	Rank/Position	Other Commitments
1.1	Carnegie Mellon University	James Russ	Professor	CDF, CMS
1.2	University of Rome	Maurizio Iori	Professor	CDF
1.3	Fermilab	Anatoly Ronzhin	PPD Physicist	PET

2 EXPERIMENTAL AREA, BEAMS AND SCHEDULE CONSIDERATIONS:

2.1 LOCATION

The beam test(s) will take place in MT6.2B.

2.2 BEAM

2.2.1 BEAM TYPES AND INTENSITIES

Energy of beam: about 1 – 2 GeV/c
Particles: electrons
Intensity: 80k particles/4 sec spill
Beam spot size: greater than 5 cm^2

The Experimenters will use a 1x1 cm^2 counter to trigger the telescope to define the beam spot independent of actual beam size. The experiment would like a counting rate in that 1 x 1 cm^2 area of about 1 kHz during the spill at 1 GeV/c to record 200 or so events/spill. Therefore, the total flux should be at least 20 kHz.

If a tune for lower energy exists, the experimenters will ask to try it at some convenient time. The experimenters would not request more than one hour of tuning time to try to achieve it. If lower energy operation is not possible under that constraint, the experiment will not go below 1 GeV/c.

2.2.2 BEAM SHARING

Any parasitic user interested in low energy running could put in a low mass detector in the MT6.1 area or could follow T-1012 in the MT6.2 area.

2.2.3 RUNNING TIME

Two access operations will be needed during the tests to insert and remove the Pb sheet. The Pb sheet will be enclosed in a polyethylene bag and inserted directly in front (relative to the beam direction) of scintillator 2 or scintillator 3. The time needed to open the box, insert the Pb and remake the optical seal with black tape is about 15 minutes.

The total beam time needed for the experiment is 9 hours, to account for delays and unexpected setbacks, the experimenters are requesting 2 days as primary user.

2.3 Experimental Conditions

2.3.1 Area Infrastructure

The experiment would use the moving table in the MT6.2 area to control horizontal and vertical steps to move the detector through the beam. FTBF will provide unistrut counter stands, BNC cables, and an Ethernet cable to run between the electronics area and the beam area, as was the case in December. The experiment will make use of the MT6.1 Cerenkov detector for counting 1 GeV electrons. Fermilab will provide the appropriate gas needed to operate the Cerenkov detector.

2.3.2 Description of Tests

The test itself consists of moving the box through the beam spot in 2 cm steps in x and/or y. The minimum study consists of a diagonal scan totaling 7 steps for each Pb configuration. In the December test the experiment collected about 350 events/spill. At that rate, one point takes 15 minutes. Including 5 additional steps per scan for symmetry checks, the experimenters estimate the run will take about 9 hours at 100% efficiency. To be conservative, the experimenters ask for two days as primary user.

2.4 Schedule

The experiment prefers to be primary user on March 4-5, 2011, but is flexible in the time frame March 2-7, up to issues with site-wide power outages starting March 7, 2011.

3 RESPONSIBILITIES BY INSTITUTION – NON FERMILAB

3.1 CARNEGIE MELLON UNIVERSITY:

3.1.1 Coordinate the test installation

3.1.2 Provide (existing) Equipment:

- set of counters [$0K]
- readout [$0K]
- Pb sheets in a suitable polyethylene enclosure [$0K]

3.2 UNIVERSITY OF ROME:

- laptop computer for DAQ in the counting area with software to communicate with the readout PC in the beam area via Ethernet connection. [$0K]

4 RESPONSIBILITIES BY INSTITUTION – FERMILAB

4.1 FERMILAB ACCELERATOR DIVISION:

4.1.1 Use of MTest beam as outlined in Section II.

4.1.2 Maintenance of all existing standard beam line elements (SWICs, loss monitors, etc) instrumentation, controls, clock distribution, and power supplies.

4.1.3 Scalers and beam counter signals should be made available in the counting house.

4.1.4 Reasonable access to the equipment in the MTest beamline.

4.1.5 Connection to beams control console and remote logging (ACNET) should be made available.

4.1.6 The test beam energy and beam line elements will be under the control of the AD Operations Department Main Control Room (MCR). [0.1 person-weeks]

4.1.7 Position and focus of the beam on the experimental devices under test will be under control of MCR. Control of secondary devices that provide these functions may be delegated to the experimenters as long as it does not violate the Shielding Assessment or provide potential for significant equipment damage.

4.1.8 The integrated effect of running this and other SY120 beams will not reduce the antiproton stacking rate and the neutrino flux by more than 5% globally, with the details of scheduling to be worked out between the experimenters and the Office of Program Planning.

4.2 FERMILAB PARTICLE PHYSICS DIVISION:

4.2.1 The test-beam efforts in this MOU will make use of the Fermilab Test Beam Facility. Requirements for the beam and user facilities are given in Section II. The Fermilab Particle Physics Division will be responsible for coordinating overall activities in the MTest beam-line, including use of the user beam-line controls, readout of the beam-line detectors, and MTest computers. [0.25 person weeks]

4.2.2 Fermilab (Ronzhin) will supply detector power supplies, amplifiers, trigger electronics and a readout computer from existing facilities at SiDet.

4.3 FERMILAB COMPUTING DIVISION

4.3.1 Internet access should be continuously available in the counting house.

4.4 FERMILAB ES&H SECTION

4.4.1 Assistance with safety reviews.

4.4.2 Provide necessary training for experimenters.

5 SUMMARY OF COSTS

Source of Funds [$K]	Materials & Services	Labor (person-weeks)
Particle Physics Division	0.0	0.25
Accelerator Division	0	0.1
Computing Division	0	0
Totals Fermilab	$0.0K	0.35
Totals Non-Fermilab	$0.0K	0.5

6 SPECIAL CONSIDERATIONS

6.1 The responsibilities of the Spokesperson and the procedures to be followed by experimenters are found in the Fermilab publication "Procedures for Researchers": (http://www.fnal.gov/directorate/PFX/PFX.pdf). The Spokesperson agrees to those responsibilities and to follow the described procedures.

6.2 To carry out the experiment a number of Environmental, Safety and Health (ES&H) reviews are necessary. This includes creating an Operational Readiness Clearance document in conjunction with the standing Particle Physics Division committee. The Spokesperson will follow those procedures in a timely manner, as well as any other requirements put forth by the Division's Safety Officer.

6.3 The spokespersons will ensure at least one person is present at the Fermilab Test Beam Facility whenever beam is delivered and that this person is knowledgeable about the experiment's hazards.

6.4 All regulations concerning radioactive sources will be followed. No radioactive sources will be carried onto the site or moved without the approval of the Fermilab ES&H section.

6.5 All items in the Fermilab Policy on Computing will be followed by the experimenters. (http://computing.fnal.gov/cd/policy/cpolicy.pdf).

6.6 The Spokesperson will undertake to ensure that no PREP or computing equipment be transferred from the experiment to another use except with the approval of and through the mechanism provided by the Computing Division management. The Spokesperson also undertakes to ensure no modifications of PREP equipment take place without the knowledge and written consent of the Computing Division management.

6.7 The experimenters will be responsible for maintaining both the electronics and the computing hardware supplied by them for the experiment. Fermilab will be responsible for repair and maintenance of the Fermilab-supplied electronics. Any items for which the experiment requests that Fermilab performs maintenance and repair should appear explicitly in this agreement.

At the completion of the experiment:

6.8 The Spokesperson is responsible for the return of all PREP equipment, computing equipment and non-PREP data acquisition electronics. If the return is not completed after a period of one year after the end of running the Spokesperson will be required to furnish, in writing, an explanation for any non-return.

6.9 The experimenters agree to remove their experimental equipment as the Laboratory requests them to. They agree to remove it expeditiously and in compliance with all ES&H requirements, including those related to transportation. All the expenses and personnel for the removal will be borne by the experimenters unless removal requires facilities and personnel not able to be supplied by them, such a rigging, crane operation, etc.

6.10 The experimenters will assist the Fermilab Divisions and Sections with the disposition of any articles left in the offices they occupied.

6.11 An experimenter will be available to report on the test beam effort at a Fermilab All Experimenters' Meeting.

SIGNATURES:

James S. Russ — 12/29/2010
James S. Russ, Experiment Spokesperson

2/25/2011
Michael Lindgren, Particle Physics Division, Fermilab

2/25/2011
Roger Dixon, Accelerator Division, Fermilab

2/22/2011
Peter Cooper, Computing Division, Fermilab

2/23/2011
Nancy Grossman, ES&H Section, Fermilab

2/27/2011
Greg Bock, Associate Director for Research, Fermilab

3/2/2011
Stuart Henderson, Associate Director for Accelerators, Fermilab

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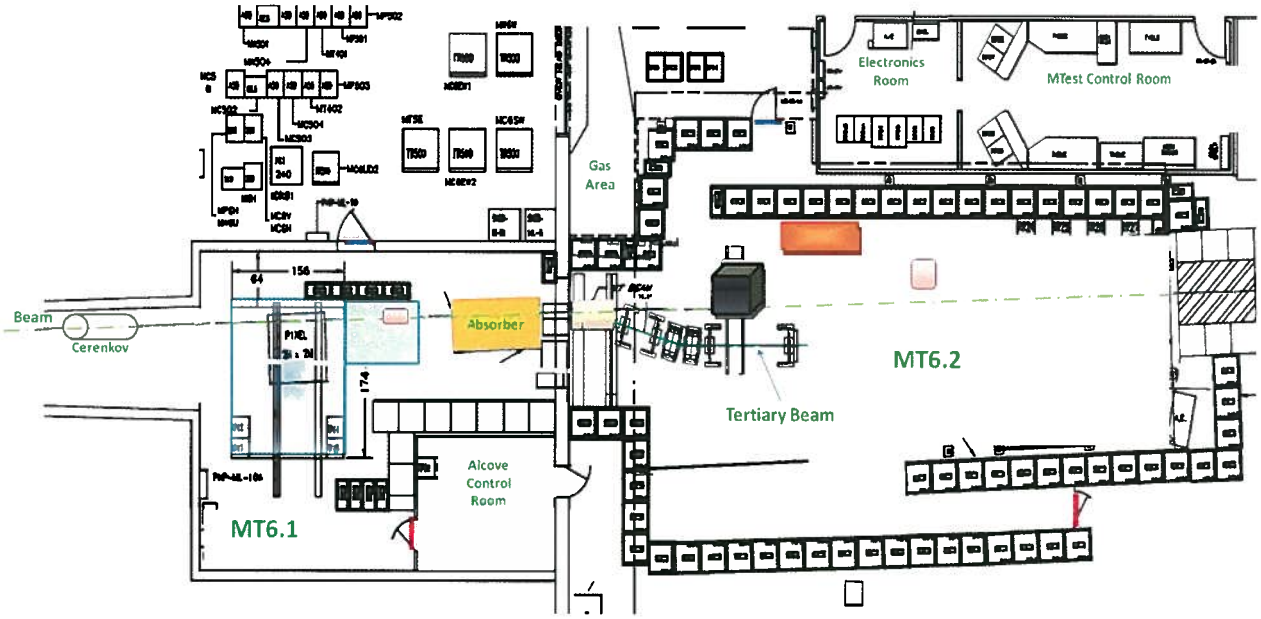
2 /27/2011
Greg Bock, Associate Director for Research, Fermilab

3 / 2/2011
Stuart Henderson, Associate Director for Accelerators, Fermilab

APPENDIX I: MT6 AREA LAYOUT

The counter box goes on the moving table at the front of MT6.2B. The PC goes on a table adjacent to the moving table on the northwest corner. The Cerenkov at the entrance to MT6.1 will be utilized.

MTEST AREAS



APPENDIX II: - HAZARD IDENTIFICATION CHECKLIST

Items for which there is anticipated need should be checked.

Cryogenics		**Electrical Equipment**		**Flammable Gases or Liquids**	
	Beam line magnets		Cryo/Electrical devices	Type:	
	Analysis magnets		capacitor banks	Flow rate:	
	Target		high voltage	Capacity:	
	Bubble chamber		exposed equipment over 50 V	**Hazardous/Toxic Materials**	
Pressure Vessels		**Other Gas Emissions**		List hazardous/toxic materials planned for use in a beam line or experimental enclosure:	
	inside diameter	Type:			
	operating pressure	Flow rate:			
	window material	Capacity:			
	window thickness	**Radioactive Sources**			
Vacuum Vessels			permanent installation	**Target Materials**	
	inside diameter		temporary use		Beryllium (Be)
	operating pressure	Type:			Lithium (Li)
	window material	Strength:			Mercury (Hg)
	window thickness	**Hazardous Chemicals**		x	Lead (Pb)
Lasers			Cyanide plating materials		Tungsten (W)
	Permanent installation		Scintillation Oil		Uranium (U)
	Temporary installation		PCBs		Other
	Calibration		Methane	**Mechanical Structures**	
	Alignment		TMAE		Lifting devices
Type:			TEA		Motion controllers
Wattage:			photographic developers		scaffolding/elevated platforms
Class:			Other: Activated Water?		Others